

SECURITY DEVICE HAVING MULTIPLE SECURITY FEATURES AND  
METHOD OF MAKING SAME

RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional  
Patent Application Serial No. 60/067,228 filed December 2, 1997,  
fully incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates to security devices and in  
particular, to a security device or element having multiple  
security features for use with valuable merchandise or items.

BACKGROUND OF THE INVENTION

Counterfeiting and tampering with secure documents or  
instruments, such as bank notes, checks, tickets, credit cards and  
the like, and other valuable merchandise or items is a common  
problem in many fields or enterprises. To prevent counterfeiting,  
many secure documents and other items of value include a security  
device or element, such as a security thread, disposed on or in  
the document. The security device typically includes one or more  
security features, such as metallic security features, magnetic  
security features, or luminescent security features, that  
authenticate the document and prevent counterfeiting and/or



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1 counterfeit more difficult. In one example, magnetic ink is  
2 used to print graphic indicia that can be read by MICR detectors.  
3 However, if magnetic ink is used to print graphic indicia on or  
4 with metallic security features, the magnetic features and  
5 metallic features are easily distinguishable and identified. A  
6 counterfeiter could recognize that both magnetic and metallic  
7 security features have been used and need to be reproduced.

8 Other types of security threads have also used hybrid metals  
9 or alloys to form graphic indicia having both magnetic and  
10 metallic security features. However, the hybrid metals and the  
11 process for depositing or applying the hybrid metals to form the  
12 graphic indicia is costly. Also, using hybrid metals limits the  
13 ability to vary the magnetic properties that can be used.

14 Accordingly, a need exists for a security device having  
15 multiple security features, such as metallic and magnetic security  
16 features, that are not easily distinguishable and recognizable  
17 upon observing the security device. A need also exists for a  
18 security device in which the security feature(s) is capable of  
19 providing machine readable encoded data, e.g., pertaining to the  
20 security device or document, in addition to detectable features  
21 for authentication of the security document. What is also needed  
22 is a method of making a magnetic/metallic security device using  
23 existing chemical etching or de-metalization techniques.

SUMMARY OF THE INVENTION

The present invention features a magnetic/metallic security device for use with an item to provide multiple security features. The security device includes a carrier substrate, a metallic layer disposed on the carrier substrate, for providing metallic security features, and a magnetic layer disposed on and in substantially identical registration with at least a portion of some of the metallic layer, for providing magnetic security features. The metallic layer and the magnetic layer together form graphic indicia on the carrier substrate, either positively or negatively. In one embodiment, a coating layer is disposed over the graphic indicia formed by the metallic layer and the magnetic layer.

The magnetic/metallic security device has different embodiments in which the magnetic layer provides magnetic security features. In one embodiment, the graphic indicia is formed as magnetic characters readable by MICR detectors. In another embodiment, the magnetic layer includes a hard magnetic substance capable of being magnetized for recording data on the magnetic layer.

In a further embodiment, the magnetic layer includes at least one type of magnetic substance having at least one predetermined magnetic characteristic that is detectable, for authenticating an item having said security device. In one example, the magnetic substance is a soft magnetic pigment capable of holding a level of magnetism for a limited period of

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1 time.

2 In a further embodiment, the magnetic layer includes at  
3 least first and second types of magnetic substances having at  
4 least first and second predetermined magnetic characteristics  
5 respectively. The first and second types of magnetic substances  
6 are arranged in the magnetic layer in a predetermined pattern  
7 representing data encoded with the magnetic layer such that the  
8 first and second predetermined characteristics are detectable to  
9 read the predetermined pattern and decode the data. In one  
10 example, the first and second predetermined magnetic  
11 characteristics represent binary integers, and the predetermined  
12 pattern of the first and second types of magnetic substances  
13 represents data in a binary coded format. One example of the  
14 first and second types of magnetic substances include first and  
15 second soft magnetic pigments having first and second  
16 predetermined magnetic decay rates and/or predetermined levels of  
17 magnetism.

18 The magnetic/metallic security device also has different  
19 embodiments in which the metallic layer provides metallic security  
20 features. In one embodiment, at least a portion of the metal  
21 layer includes at least one predetermined characteristic that is  
22 detectable, for authenticating an item having the security  
23 device.

24 In another embodiment, the metal layer forms a plurality of  
25 conductive regions on the substrate. The conductive regions are  
26 separated by non-conductive regions and have at least two

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1 different predetermined lengths forming a predetermined pattern  
2 for representing encoded data. The predetermined lengths of the  
3 conductive regions are detectable to read the predetermined  
4 pattern and decode the data. In one example, the conductive  
5 regions include first and second predetermined lengths  
6 representing binary integers, and the predetermined pattern of  
7 the first and second lengths of the conductive regions encodes  
8 the data in a binary coded format.

9 The present invention also features a magnetic security  
10 device for use with an item. The magnetic security device  
11 comprises a carrier substrate, and a plurality of magnetic  
12 regions disposed on the carrier substrate. The plurality of  
13 magnetic regions have different predetermined magnetic  
14 characteristics and are arranged in a predetermined pattern  
15 representing data encoded by the magnetic regions. The first and  
16 second predetermined characteristics are detectable to read the  
17 predetermined pattern and decode the data.

18 The present invention also features a metallic security  
19 device for use with an item. The metallic security device  
20 comprises a carrier substrate, and a plurality of conductive  
21 regions disposed on the carrier substrate. The conductive  
22 regions are separated by non-conductive regions and have at least  
23 two different predetermined lengths forming a predetermined  
24 pattern for representing encoded data. The predetermined lengths  
25 of the conductive regions are detectable to read the  
26 predetermined pattern and decode the data.



1  
2 DESCRIPTION OF THE DRAWINGS

3 These and other features and advantages of the present  
4 invention will be better understood by reading the following  
5 detailed description, taken together with the drawings wherein:

6 Fig. 1 is a top view of a document or item having a security  
7 device, according to the present invention;

8 Fig. 2 is an enlarged top view of a magnetic/metallic  
9 security device, according to one embodiment of the present  
10 invention;

11 Figs. 3A-3C are side, cross-sectional views of a method of  
12 making the magnetic/metallic security device, according to the  
13 present invention;

14 Fig. 4A is a top view of a magnetic/metallic security device  
15 having magnetic tracks, according to one embodiment of the present  
16 invention;

17 Fig. 4B is a schematic and graphical illustration of the  
18 magnetic/metallic security device having machine readable encoded  
19 magnetic and metallic security features, according to one  
20 embodiment of the present application;

21 Fig. 5 is a functional block diagram of a device for  
22 detecting or reading the magnetic security features, according to  
23 one embodiment of the present invention; and

24 Fig. 6 is a schematic illustration of a machine readable  
25 encoded metallic security feature, according to one embodiment the  
26 present invention;



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Fig. 7 is a side cross-sectional view of the machine readable encoded metallic security feature and capacitive sensors, for reading the encoded data, according to one embodiment of the present invention;

Fig. 8 is an enlarged top view of a machine readable metallic security feature, according to another embodiment of the present invention;

Fig. 9 is an enlarged top view of a machine readable metallic security feature, according to a further embodiment of the present invention;

Fig. 10 is an enlarged view of a machine readable metallic security feature, according to yet another embodiment of the present invention; and

Fig. 11 is a schematic representation of a security instrument, according to one embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A security device 10, Fig. 1, according to the present invention, is used with an item 12 to prevent counterfeiting or reproduction of the item 12 or another article to which the item 12 is attached. The security device 10 has multiple security features, such as metallic security features and magnetic security features, capable of being encoded with data in a machine readable format in addition to providing authentication of the item 12. The metallic and magnetic security features are preferably formed by using a magnetic chemical resist, as will be described in

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1 greater detail below, such that at least some of the metallic and  
2 magnetic security features are generally perfectly superimposed  
3 and substantially indistinguishable by the naked eye.

4 The security device 10 can be used in secure documents  
5 including, but not limited to, banknotes, currencies, passports,  
6 visas, titles, licenses, registrations, checks, money orders,  
7 original documents, certificates of authority, event tickets and  
8 gift certificates. The security device 10 provides authentication  
9 of the secure document and/or is encoded with data pertaining to  
10 the secure document or the security device itself.

11 The security device 10 can also be used in labels, tags or  
12 packaging material including, but not limited to, pressure  
13 sensitive labels, glue-on labels, in-mold labels, heat-shrink  
14 labels, woven labels, tear tapes, shrink-caps and collars, and  
15 stickers. In this example, the magnetic/metallic security device  
16 10 authenticates and/or is encoded with data relating to the  
17 articles to which the labels or packaging material is attached,  
18 such as liquor or other commodities of value.

19 The security device 10 can further be used with a laminated  
20 article including, but not limited to, passports, ID Cards, access  
21 cards, licenses, and credit/debit cards. In this example, the  
22 security device 10 is used to authenticate the laminated article  
23 and/or is encoded with data relating to the article or the owner  
24 of the article.

25 The security device 10 can also be used in tickets or passes  
26 including, but not limited to, event tickets, transit tickets,



the graphic indicia 16 is composed of the magnetic/metallic medium. The magnetic/metallic security device 10 can also be formed with a combination of positive and reverse graphic indicia 16. The graphic indicia 16 can be printed as line work in which solid areas are printed in the desired shape or as halftone in which tiny dots are printed with varying spacing to vary the shading. Although the graphic indicia 16 are shown as alphanumeric characters, the present invention contemplates any type of symbol, design, shape or other graphic indicia.

The method of making the exemplary security device 10, Figs. 3A and 3B, according to the present invention, includes first applying a metallic layer 20 to the carrier substrate 14. The metallic layer 20 preferably includes aluminum that has been sputtered or vapor deposited on the carrier substrate 14. Alternatively, the metallic layer 20 can be a metallic foil or other type of metal applied to the carrier substrate 14.

Next, a magnetic chemical resist 22 is applied to the metallic layer 20 according to the desired pattern of graphic indicia 16, e.g. printed in positive, reverse or both. The magnetic chemical resist 22 includes film-forming chemical resisting resins containing ferromagnetic and or other magnetic pigments. Examples of the chemical resist include, but are not limited to, solvent based, water based or solid based, ultra violet (UV) or electron beam (EB) polymerized resin systems or other conventional chemical resist resins. The magnetic pigments include both hard and soft magnetic pigments, as will be described

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1 in greater detail below, typically ranging from about 200 oersteds  
2 to 10,000 oersteds.

3 An etching process is then performed on the magnetic/metallic  
4 security device 10, Fig. 3B, that removes portions of the metallic  
5 layer 20 that are not protected by the magnetic chemical resist  
6 22. The etching process includes conventional chemical etching  
7 processes known to those of ordinary skill in the art. The  
8 magnetic chemical resist 22 resists the chemical attack and  
9 remains on the underlying metallic layer 20, arranged in the  
10 desired printed pattern. The magnetic chemical resist 22 is  
11 superimposed in substantially identical registration with at least  
12 a portion of the underlying metal layer 20, thereby providing both  
13 magnetic and metallic security features that are substantially  
14 indistinguishable in at least some areas of the security device  
15 10. The magnetic chemical resist 22 thus acts both to resist  
16 chemical attack while etching the metallic layer 20 and to provide  
17 a magnetic security feature superimposed on the metallic security  
18 feature so as to be not easily identified.

19 Alternatively, the graphical indicia 16 can be formed using  
20 other types of techniques including, but not limited to, lasers,  
21 mechanical scribing, abrading, and the like. In one example, a  
22 substrate containing a metallic layer is over-coated with a  
23 magnetic layer and subjected to a laser etching process. The  
24 laser etching selectively removes both the magnetic and metallic  
25 layers and forms the desired graphical indicia 16 having the  
26 magnetic security feature superimposed substantially identically

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1 over the metallic security feature.

2 The present invention also contemplates using an additional  
3 coating or laminate 24, Fig. 3C, over the graphic indicia 16, on  
4 one or both sides. In one example, the additional layer 24 is  
5 used to help hide the security device 10 when embedded in paper  
6 and viewed with reflected light. In this case, however, the  
7 graphic indicia 16 created with the magnetic chemical resist will  
8 remain observable when viewed in transmitted light.

9 The security device 10, Figs. 4A and 4B, can be encoded with  
10 machine readable analog or digital data as well as provide  
11 authentication in multiple ways by using the various properties of  
12 the metallic and magnetic security features. Using one or more  
13 metallic and/or magnetic properties to authenticate the security  
14 device 10 or item 12 involves detecting whether or not the one or  
15 more properties are present on the security device 10. Using the  
16 one or more metallic and/or magnetic properties to encode as  
17 analog or digital data involves detecting and reading a  
18 combination of properties that represents a numerical code, e.g.  
19 in Binary-Coded Decimal (BCD) format, and decoding the code to  
20 determine the data represented thereby.

21 The magnetic security feature is capable of authenticating an  
22 item or encoding data pertaining to the item in multiple ways. In  
23 one example, the graphic indicia 16 are formed as magnetic  
24 characters that can be read by conventional MICR detectors. In  
25 this example, the graphic indicia 16 <sup>are</sup> ~~is~~ preferably formed as  
26 positive text.



1 For example, the graphic indicia segments 16a-16d can include two  
2 types of soft magnetic pigments, one having a fast decay rate 28a  
3 and one having a slow decay rate 28b, <sup>28c</sup> that represent binary  
4 integers encoding data in BCD format. Some segments 16a, 16c of  
5 the graphic indicia are printed with magnetics having a fast decay  
6 rate and other segments 16b, 16d of the graphic indicia are  
7 printed with magnetics having a slow decay rate. Data is thereby  
8 encoded in BCD format (0101) by providing a predetermined pattern  
9 of segments 16a-16d having the two different types of magnetic  
10 pigments. The encoded data can include verification data or other  
11 data pertaining to the item 12.

12 According to one method of the present invention, different  
13 formulations of the magnetic chemical resist 22 having magnetic  
14 pigments with different magnetic properties or characteristics are  
15 printed onto the metallic layer 20 using multiple print stations,  
16 such as an offset printing press similar to the type used for  
17 multicolor printing. Using multiple print stations allows graphic  
18 indicia to be printed in any desired pattern using various  
19 combinations of magnetic chemical resists having various different  
20 magnetic properties.

21 The present invention also contemplates simultaneously using  
22 the level of magnetism and decay rate properties of the soft  
23 magnetics, as well as a mixture of hard and soft magnetics to  
24 achieve any desired combination of magnetic characteristics or  
25 properties for authenticating an item or encoding data pertaining  
26 to an item. Although the exemplary embodiment described above





1 has a predetermined decay rate.

2       Decoding is performed by determining the pattern of the  
3 different magnetic characteristics read by the reader 34. For  
4 example, if the magnetic/metallic security device 10 shown in Fig.  
5 4 is magnetized with the magnetizer 32, after a period of time,  
6 the segments 16b, 16d having a slower decay rate <sup>28c</sup> will remain  
7 magnetized while the segments 16a, 16c having a faster decay rate  
8 28a will no longer be magnetized. The reader 34 distinguishes the  
9 different magnetic properties and determines the predetermined  
10 pattern of magnetic properties. From the predetermined pattern of  
11 magnetic properties, the corresponding binary representation  
12 (0101) and the data represented thereby is decoded.

13       The metallic security feature 40, Fig. 6, according to one  
14 embodiment of the present invention, includes a plurality of  
15 conductive regions 42 and non-conductive regions 44, such as a  
16 metallized polyester film having demetalized breaks, for example,  
17 formed using the chemical resist process described above. Each  
18 non-conductive region 44 is disposed between two of the conductive  
19 regions 42. The plurality of conductive regions 42 and non-  
20 conductive regions 44 form a predetermined pattern that represents  
21 a verification code or data encoded with the metallic security  
22 feature 40.

23       Each conductive region 42 has one of at least two  
24 predetermined lengths, for example, long conductive regions 42a  
25 and short conductive regions 42b. Each predetermined length  
26 corresponds to a predetermined value so that the data can be

determined by detecting the length of each conductive region 42 and determining a corresponding value.

In one example, long conductive regions 42a correspond to a "1" and the short conductive regions 42b corresponds to a "0".

According to this example, the long and short conductive regions 42a, 42b are used to encode data in BCD format. The long and short conductive regions 42a, 42b are arranged in a predetermined series corresponding to the binary representation of the data to be encoded. In this example, the detector/reader 34 detects the length of each conductive region 42 in the series (e.g. long or short) and determines the corresponding binary representation. To provide authentication, the binary representation will be matched to a predefined verification code for an item 12. To read encoded data, the binary representation will be further decoded.

Accordingly, depending upon the arrangement of the conductive regions 42 having varying lengths, a virtually unlimited number of verification codes or data can be encoded using the machine readable metallic security feature 40. The machine readable metallic security feature 40 according to the present invention allows encoded data to be easily varied by varying the sequence of the conductive regions 42a, 42b. The conductive regions can be formed according to various designs provided that they are conductive over one of the predetermined lengths, as will be described in greater detail below. Although only two lengths are discussed herein for simplification, the present invention contemplates using conductive regions of any number of different

1 lengths for encoding data. For example, octal data can be encoded  
2 using eight (8) different length conduction regions.

3 One method of reading and verifying the machine readable  
4 metallic security feature 40, Fig. 7, is by detecting the long and  
5 short conductive regions 42a, 42b using capacitive verification or  
6 detection, such as disclosed in U.S. Patent No. 5,419,424 issued  
7 to Harbaugh and incorporated herein by reference. According to  
8 capacitive verification methods, the machine readable metallic  
9 security feature 40 is positioned proximate capacitive sensors 50  
10 coupled to a verification device (not shown). When capacitive  
11 sensors 50 are positioned proximate conductive regions 42, the  
12 conductive regions 42 capacitively couple one sensor 52a to  
13 another sensor 52b. Where there is a non-conductive region 44 or  
14 "break" in the conductivity, there will be no capacitive coupling  
15 between the adjacent capacitive sensors 52b, 52c on either side of  
16 the non-conductive region 44. By detecting the changes in  
17 capacitance when the machine readable encoded metallic security  
18 feature 40 is positioned proximate the capacitive sensors 50, the  
19 presence of the long and short conductive regions 42a, 42b are  
20 effectively detected. The present invention also contemplates  
21 other verification devices and methods capable of detecting the  
22 lengths of the conductive regions 42a, 42b, such as various  
23 electromagnetic verification devices.

24 The conductive regions 42 of the machine readable encoded  
25 metallic security feature 40 are preferably formed from a metallic  
26 material, such as aluminum. Exemplary methods include, but are not



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1 42b using capacitive sensors 52.

2 According to another embodiment of the machine readable  
3 encoded metallic security feature 40b, Fig. 9, the conductive  
4 regions 42 are formed as conductive indicia regions 62a-62c formed  
5 from a conductive material, for example, printed with metallic ink  
6 or formed with a chemical resist process. The conductive indicia  
7 regions 62a, 62c are established by having the individual  
8 characters or symbols 49a-49f of the indicia connected at contact  
9 points 48 and separated at the non-conductive regions 44. The  
10 conductive indicia regions 62a-62c thus have predetermined lengths  
11 and are arranged in predetermined patterns representing the  
12 encoded data to be detected, as discussed above. The conductive  
13 indicia regions 62a-62c include alpha-numeric characters as well  
14 as other symbols or characters used for providing an additional  
15 verification code or to provide false patterns that deceive the  
16 counterfeiter and hide the true encoded data.

17 A further embodiment of the machine readable encoded metallic  
18 security feature 40c, Fig. 10, of the present invention includes  
19 conductive regions 42a-42c, such as narrow regions of metallic  
20 material, and non-conductive indicia regions 64a-64c breaking the  
21 conductivity between the conductive regions 42a-42c. For example,  
22 specific alpha-numeric characters or other symbols can be formed  
23 of non-conductive material or by a chemical resist or demetalizing  
24 process between the conductive regions 42a-42c to provide the  
25 "break" in conductivity. The alpha-numeric characters or other  
26 symbols constituting the non-conductive indicia regions 64a-64c

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1 further provide additional data or codes and false patterns that  
2 deceive the counterfeiter and hide the true encoded data.

3 The present invention contemplates using the magnetic  
4 security features and metallic security features alone or together  
5 on a security device. Any number of the magnetic or metallic  
6 properties described above can be used individually or combined  
7 with other properties to provide authentication of an item, encode  
8 data pertaining to an item, or both.

9 According to the various embodiments of the present  
10 invention, one or more security devices or threads 10, Fig. 11,  
11 can be provided in various locations on or embedded in a secure  
12 document or instrument 70. The one or more security devices 10  
13 are also readable in various directions as well as right side up  
14 or upside down. In one example, the secure instrument 70 is  
15 formed by gluing the security device 10 between two half-weight  
16 layers of paper which are then laminated together. In this  
17 example, the security device 10 is preferably unlaminated so that  
18 any attempt to delaminate the instrument 70 and remove the  
19 security device 10 will cause the paper laminating adhesive to  
20 remove the metallic and/or magnetic security features and alter  
21 the security feature or encoded data.

22 One example of the instrument 70 is a ticket used for  
23 sporting events, concerts, theater, shows, lotteries,  
24 transportation, theme parks, fairs, and other events. The  
25 security device 10 in the ticket can be encoded with a  
26 predetermined authentication code or encoded data that can be read

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1 when the security instrument 70 is presented, e.g. upon admission  
2 to a particular event. In one example, one full code 72 appears  
3 in approximately 2.5 in.

4 Accordingly, the security device of the present invention  
5 authenticates an item and/or is encoded with data pertaining to  
6 the item in numerous ways with one or more security features, such  
7 as metallic security features and magnetic security features that  
8 generally appear together as one single security feature. The  
9 security features and encoded data are thus more difficult to  
10 identify and reproduce. The method of making the security device  
11 using chemical etching and a magnetic chemical resist results in a  
12 magnetic security feature that is substantially indistinguishable  
13 from a metallic security feature. The method of printing graphic  
14 indicia using a magnetic chemical resist also facilitates the use  
15 of magnetic pigments having different magnetic characteristics or  
16 properties by printing different formulations of the magnetic  
17 chemical resist.

18 Modifications and substitutions by one of ordinary skill in  
19 the art are considered to be within the scope of the present  
20 invention which is not to be limited except by the claims which  
21 follow.

22 What is claimed is: